3.2 Environmental Setting

The Puget Sound Action Area includes all marine waters of the State of Washington east of, and including the Strait of Juan de Fuca. The action area also includes all State of Washington freshwater tributaries of these marine waters east of the Strait of Juan de Fuca, and the freshwater tributaries of the Strait of Juan de Fuca east of, and including the Elwha River drainage.

Using definitions found in *Washington Place Names* (Reese 2002), the action area has been divided into four distinct regions: 1) Strait of Juan de Fuca; 2) Hood Canal; 3) South Puget Sound; and 4) North Puget Sound (Figure 3.2-1). There are 12 Washington counties within the action area (Figure 3.2-2).

Strait of Juan de Fuca. This 90-mile long waterway between British Columbia (Canada) and Washington State, with an average width of 13 miles, extends from the Pacific Ocean at Cape Flattery to the vicinity of Port Townsend in the United States and Victoria in British Columbia (see Figure 3.2-1). The action area includes only the waters of the United States. Washington counties Clallam and Jefferson border the south side of the Strait of Juan de Fuca. Major river systems draining into the Strait of Juan de Fuca include the Elwha River and the Dungeness River in Clallam County (Table 3.2-1).

Hood Canal. This saltwater channel extends southwest from the vicinity of Port Ludlow in Jefferson County through Kitsap and Mason counties, to the Great Bend at Union, then northeast to Belfair in Mason County (see Figure 3.2-1). It is an arm of the great inland sea of western Washington. Major freshwater drainages within Hood Canal include the Skokomish, Hamma Hamma, Dosewallips, Duckabush, and the Big and Little Quilcene Rivers (Table 3.2-1).

South Puget Sound. For the purpose of this Environmental Impact Statement, the marine area defined in *Washington Place Names* as Puget Sound is referred to as South Puget Sound. South Puget Sound is an inland, saltwater sound that extends about 53 miles south from Point Wilson near Port Townsend in western Washington (see Figure 3.2-1). It extends southwesterly approximately 30 miles to Budd Inlet, with other branches in Thurston and Mason counties. It does not include Hood Canal, Port Susan, Bellingham Bay or the San Juan Island waterways. Major freshwater drainages that discharge to South Puget Sound are listed in Table 3.2-1.

1 Figure 3.2-1. The Puget Sound Action Area and regions within the action area.

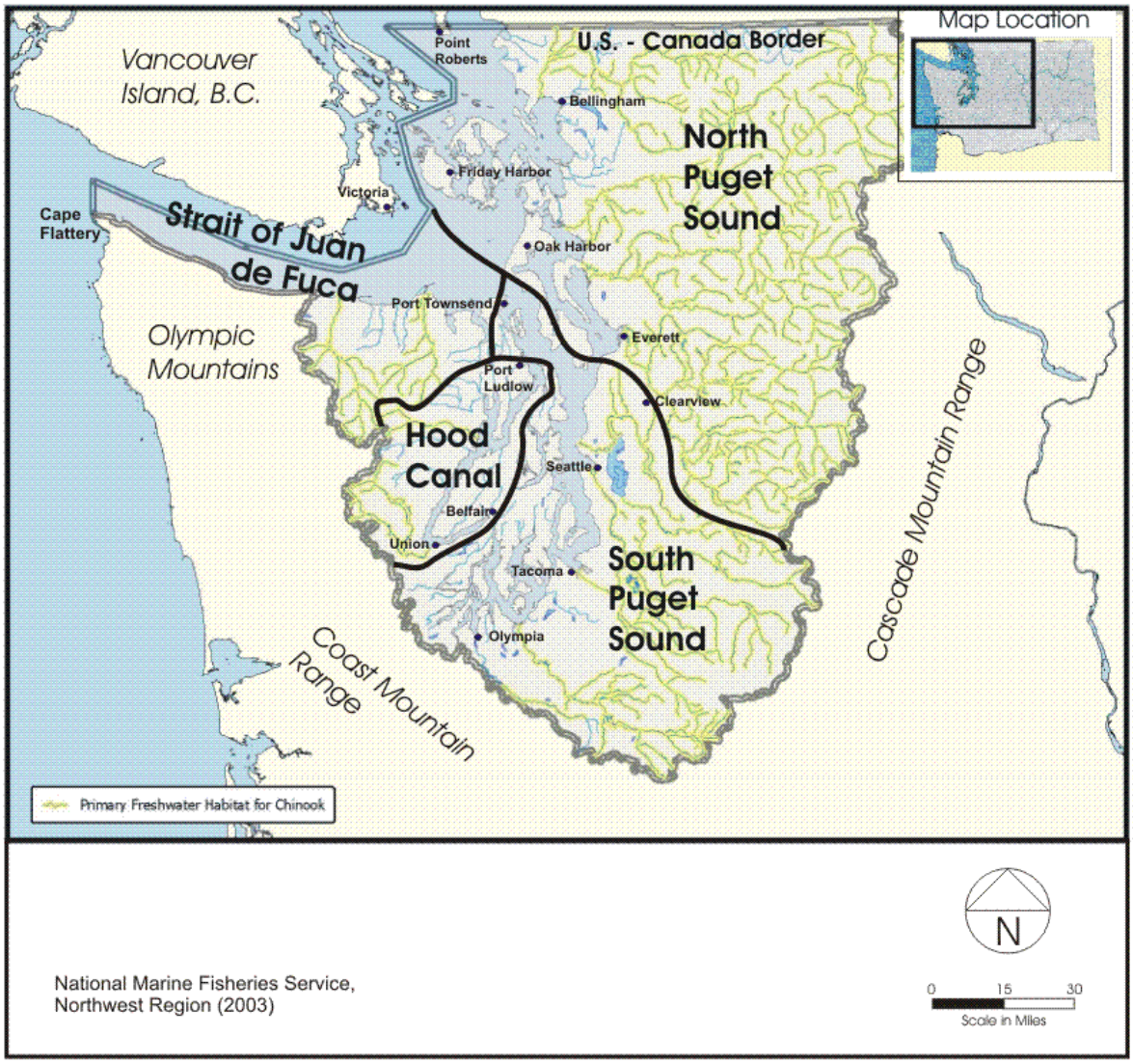

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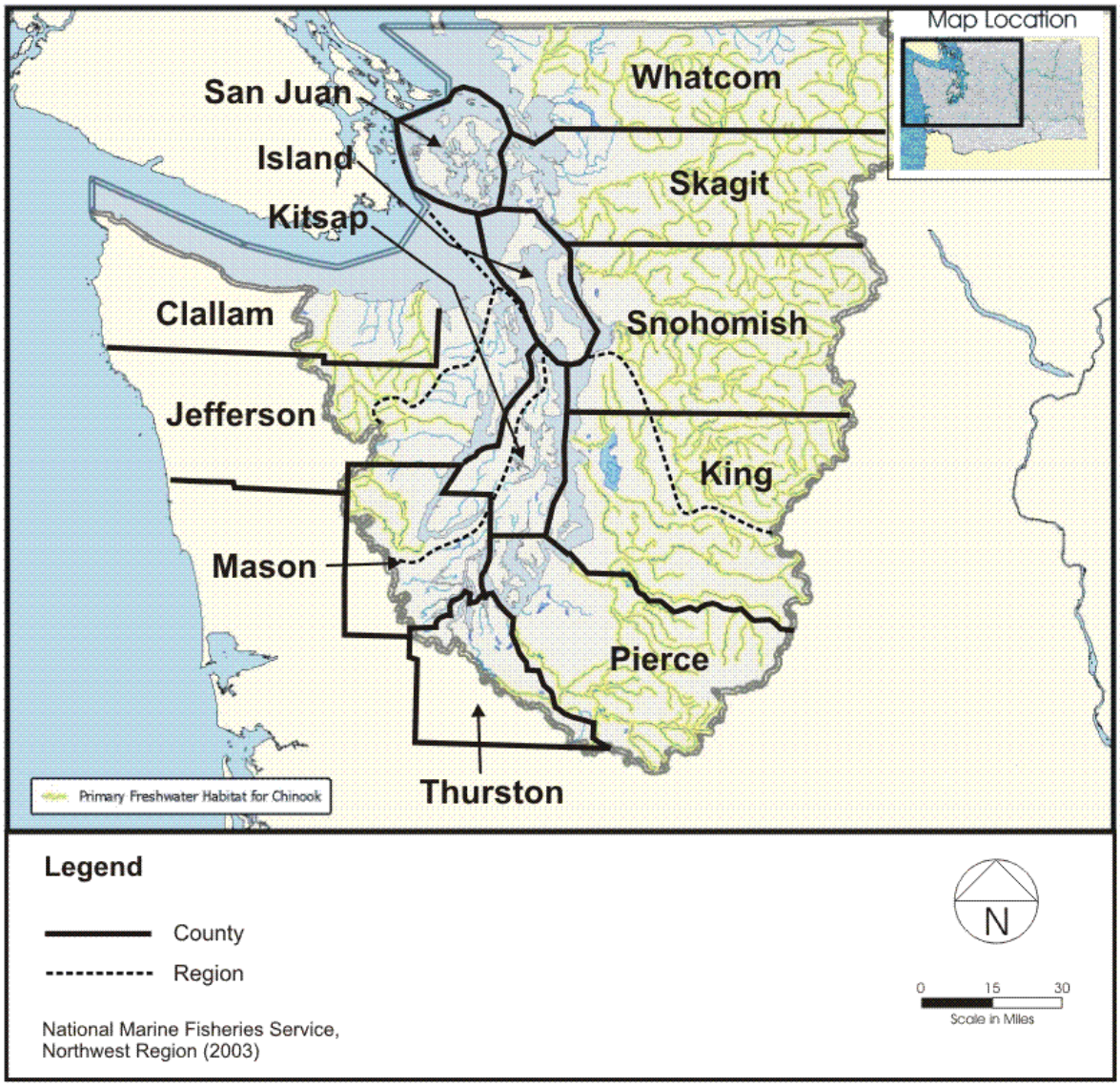
Figure 3.2-2. Washington counties within the Puget Sound Action Area.



North Puget Sound. The northern portion of the action area, including the U.S. marine areas referred to as Port Susan, Bellingham Bay, the Strait of Georgia, the marine waters of the San Juan Islands, and the marine waters of the San Juan Archipelago, are collectively referred to herein as North Puget Sound (Figure 3.2-3). Major drainages that enter North Puget Sound include the Nooksack, Samish, Skagit, Stillaguamish, and Snohomish Rivers (Table 3.2-1).

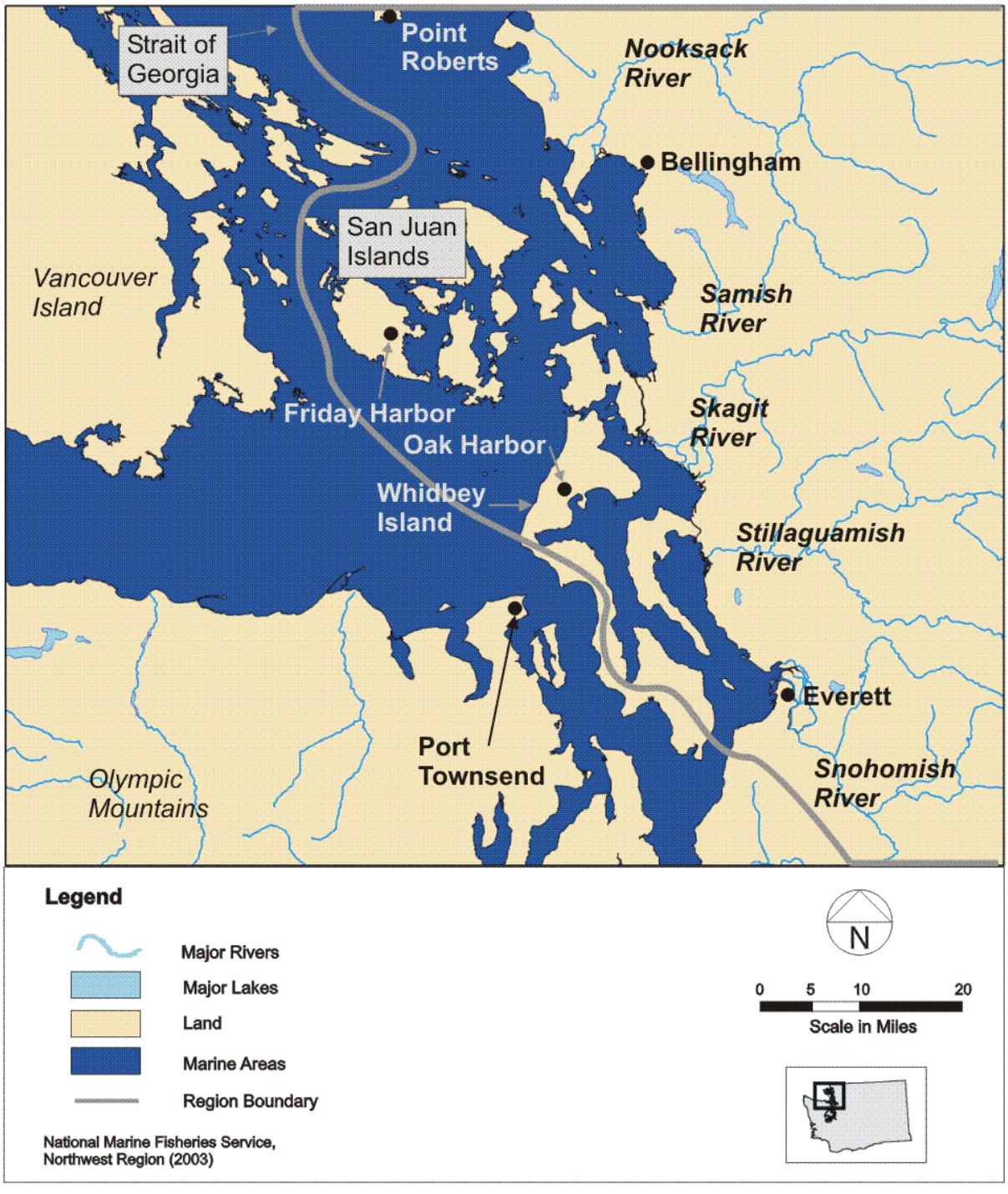
Table 3.2-1. Major river systems within the four regions of the Puget Sound Action Area.

Region	Major River Systems
Strait of Juan de Fuca	Elwha River Dungeness River
Hood Canal	Skokomish River Hamma Hamma River Dosewallips River Duckabush River Big Quilcene River Little Quilcene River
South Puget Sound	Cedar River Green/Duwamish River Puyallup River Nisqually River Deschutes River
North Puget Sound	Nooksack River Samish River Skagit River Stillaguamish River Snohomish River

3.2.1 Physical Description of the Action Area

The Puget Sound Action Area is bounded on the east by the Cascade Mountain Range and on the west by the Olympic Mountains. Its northern part reaches the international boundary between the United States and Canada, and it ends at the base of the low hills of the Coast Mountain Range near Olympia (Figure 3.2-1). The surrounding land mass of the action area includes approximately 13,600 square miles, 20 percent of the total surface land mass within Washington state (66,582 square miles).

Figure 3.2-3. The North Puget Sound region of the Puget Sound Action Area.



Freshwater inflow into Puget Sound, Hood Canal, and the eastern part of the Strait of Juan de Fuca is approximately 900 million gallons per day. The major sources of fresh water are the Skagit and Snohomish Rivers. However, the annual amount of fresh water entering Puget Sound is only 10 to 20 percent of the amount entering the Strait of Georgia. The majority of the fresh water entering the Strait of Georgia is conveyed by the Fraser River drainage, a major drainage in southwestern Canada (Gustafson et al. 2000). The Fraser River enters the Strait of Georgia approximately 10 miles north of the United States border.

The marine surface area of the Puget Sound Action Area is approximately 900 square miles, within 2,000 miles of coastline (Gustafson et al. 2000). The average depth of Puget Sound at mean low tide is 205 feet, The average surface water temperature is 55^{o} F in summer and 45^{o} F in winter (Staubitz et al. 1997). Estuarine circulation in Puget Sound is driven by tides, gravitational forces, and freshwater inflows.

The largest habitat type within the Puget Sound Action Area is kelp beds and eelgrass meadows, which cover almost 400 square miles. Other major habitats include subaerial and intertidal wetlands (68 square miles), and mudflats and sandflats (95 square miles) (Gustafson et al. 2000). The extent of some of these habitats has markedly declined over the last century. Hutchinson (1988) indicated that 58 percent of intertidal habitat in Puget Sound has been lost since European settlement. Four river deltas (the Duwamish, Lummi, Puyallup, and Samish Rivers) have lost more than 92 percent of their intertidal marshes (Simenstad et al. 1982; and Schmitt et al. 1994, as cited in Gustafson et al. 2000). At least 76 percent of the wetlands around Puget Sound have been eliminated, especially in urbanized estuaries. Substantial declines of mudflats and sandflats have also occurred in the deltas of these estuaries (Levings and Thom 1994, as cited in Gustafson et al. 2000).

Geologic history of the area includes repeated advances and retreats of continental ice sheets from Canada. The continental ice sheet reached its maximum advance about 14,000 years ago (Kruckeberg 1991). It was the action of ice and its later melt waters that gave shape to many of the features of the Puget Sound area landscape of today.

Three dominant climate factors influence the weather of Puget Sound. They are 1) the Pacific Ocean, acting as the region's thermostat and generator of moisture-laden air; 2) the semi-permanent high and low-pressure cells that hover over the North Pacific Ocean that propel the maritime air in the direction of Puget Sound; and 3) the mountains bordering Puget Sound, that regulate the flow of the regional atmosphere. The combined effects of these factors result in a generally predictable climate, described as "maritime;" i.e., mild and wet. Precipitation is mainly in the form of rain, of which more than 75

percent falls between October and March. With the exception of areas within the "rain shadow" of the Olympic Mountains, most areas within the Puget Sound Action Area receive 36 to 52 inches of precipitation per year, with an average of 40.3 inches (Kruckeberg 1991).

3.2.2 Resident Population within the Action Area

The total resident human population of the 12 counties within the action area on April 1, 2000, as reported by the United States Census Bureau, was 3,978,513 (Table 3.2-2). Approximately 67.5 percent of the entire Washington State population of 5,894,121 resided within these 12 counties at that time (United States Census 2000). Most of the population lives near the shores of Puget Sound and in the alluvial valleys of major rivers. American Indian and Alaska Natives represented approximately 1.4 percent of the population.

Table 3.2-2. April 1, 2000 resident population of Puget Sound Action Area counties.

Region	Washington County	April 1, 2000 Resident Population	Percent American Indian and Alaska Native [1]
Strait of Juan de Fuca	Clallam	64,525	5.1%
Hood Canal	Jefferson	25,953	2.3%
	Kitsap	231,969	1.6%
	Mason	49,405	3.7%
South Puget Sound	King	1,737,034	0.9%
	Pierce	700,820	1.4%
	Thurston	207,355	1.5%
North Puget Sound	Snohomish	606,024	1.4%
	Skagit	102,979	1.9%
	Whatcom	166,814	2.8%
	Island	71,558	1.0%
	San Juan	14,077	0.8%
Total	12 Counties	3,978,513	1.4%

[1] The proportionate occurrence of American Indian and Alaska Native populations is noted for purposes of the Environmental Justice analysis of potential impacts to minority populations that have a significant reliance on Puget Sound Chinook salmon. The United States Census 2000 defined American Indian and Alaska Native as a "person having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment" (United States Census 2000).

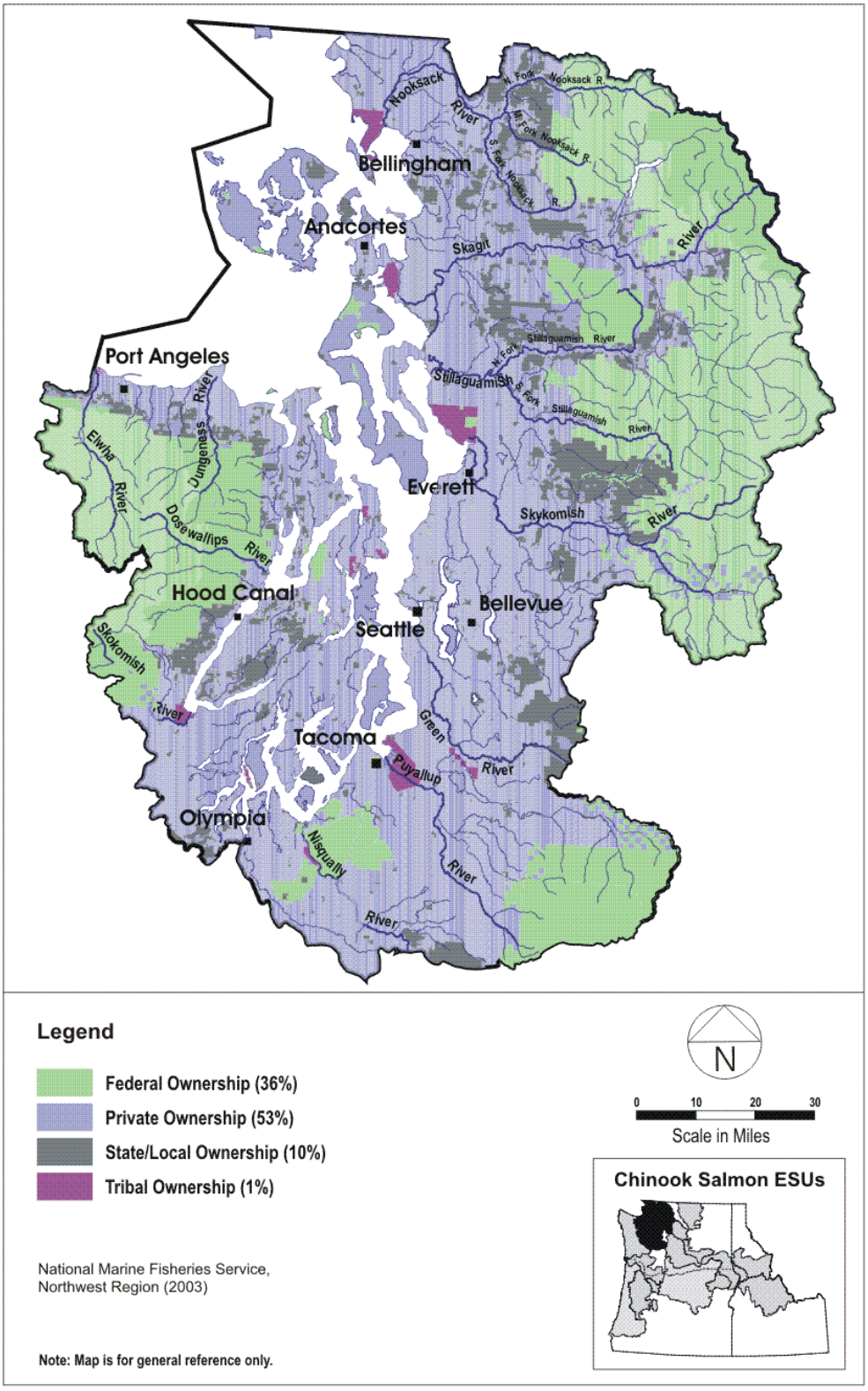
3.2.3 Evolutionarily Significant Units within the Action Area

An Evolutionarily Significant Unit (ESU) is a distinctive group of Pacific salmon or steelhead (National Marine Fisheries Service 2003). The Puget Sound Action Area includes the geographic range of two ESUs: the Puget Sound Chinook ESU, and the Hood Canal Summer-Run Chum ESU.

Puget Sound Chinook Salmon Evolutionarily Significant Unit: The Puget Sound Chinook Salmon Evolutionarily Significant Unit was listed as a threatened species on March 24, 1999 (64 Federal Register 14308). The Puget Sound Action Area includes the entire area of the Puget Sound Chinook Salmon Evolutionarily Significant Unit. The Puget Sound Chinook Salmon Evolutionarily Significant Unit encompasses all runs of chinook salmon within Puget Sound, from the Elwha River on the Olympic Peninsula to the North Fork Nooksack River (Figure 3.2-4).

Chinook salmon are found in most of the rivers within the action area. The Washington Department of Fisheries (WDF et al. 1993) recognized 27 distinct stocks of chinook salmon: eight spring-run, four summer-run, and 15 summer/fall and fall-run stocks. The existence of an additional five spring-run stocks has been disputed among different management agencies (WDF et al. 1993). The Skagit River and its tributaries were historically the predominant system in Puget Sound that supported naturally-spawning populations of Puget Sound chinook salmon (WDF et al. 1993).

Figure 3.2-4. Puget Sound Chinook Salmon Evolutionarily Significant Unit: Land ownership pattern.



The Puget Sound Technical Recovery Team has proposed a more recent analysis of the population structure of chinook salmon within the action area. The Puget Sound Technical Recovery Team is an independent scientific body convened by the National Marine Fisheries Service (NMFS) to develop technical delisting criteria and guidance for salmon delisting in Puget Sound. The Technical Recovery Team has narrowed the earlier population delineation to 22 demographically-independent populations representing the primary historical spawning areas of chinook salmon in Puget Sound (M. Ruckelshaus, chair Puget Sound Technical Recovery Team, personal communications with K. Schultz, NMFS, January 8, 2003). These proposed populations include: North Fork Nooksack River, South Fork Nooksack River, upper Skagit River, lower Sauk River, lower Skagit River, upper Sauk River, Siuattle River, upper Cascade River, North Fork Stillaguamish River, South Fork Stillaguamish River, Skykomish River, Snoqualmie River, Cedar River, north Lake Washington tributaries, Green River, White River, Puyallup River, Nisqually River, Skokomish River, Dosewallips River, Dungeness River, and the Elwha River (Figure 3.2-5).

Chinook salmon (and their progeny) from the following hatchery stocks are also considered part of the listed Puget Sound Chinook Salmon Evolutionarily Significant Unit: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness River (spring run); and Elwha River (fall run).

Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Unit: The Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Unit was listed as a threatened species on March 25, 1999 (64 Federal Register 14570). This Evolutionarily Significant Unit includes summer-run chum salmon populations in Hood Canal and in Discovery Bay and Sequim Bay within the Strait of Juan de Fuca region (Figure 3.2-6). The Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Unit may also include summer-run chum salmon in the Dungeness River, but the existence of that run is uncertain at this time.

Listed species of Puget Sound salmon are discussed in more detail in Subsection 3.3 of this Environmental Impact Statement.

Figure 3.2-5. Proposed demographically-independent populations in the Puget Sound Salmon Evolutionarily Significant Unit.

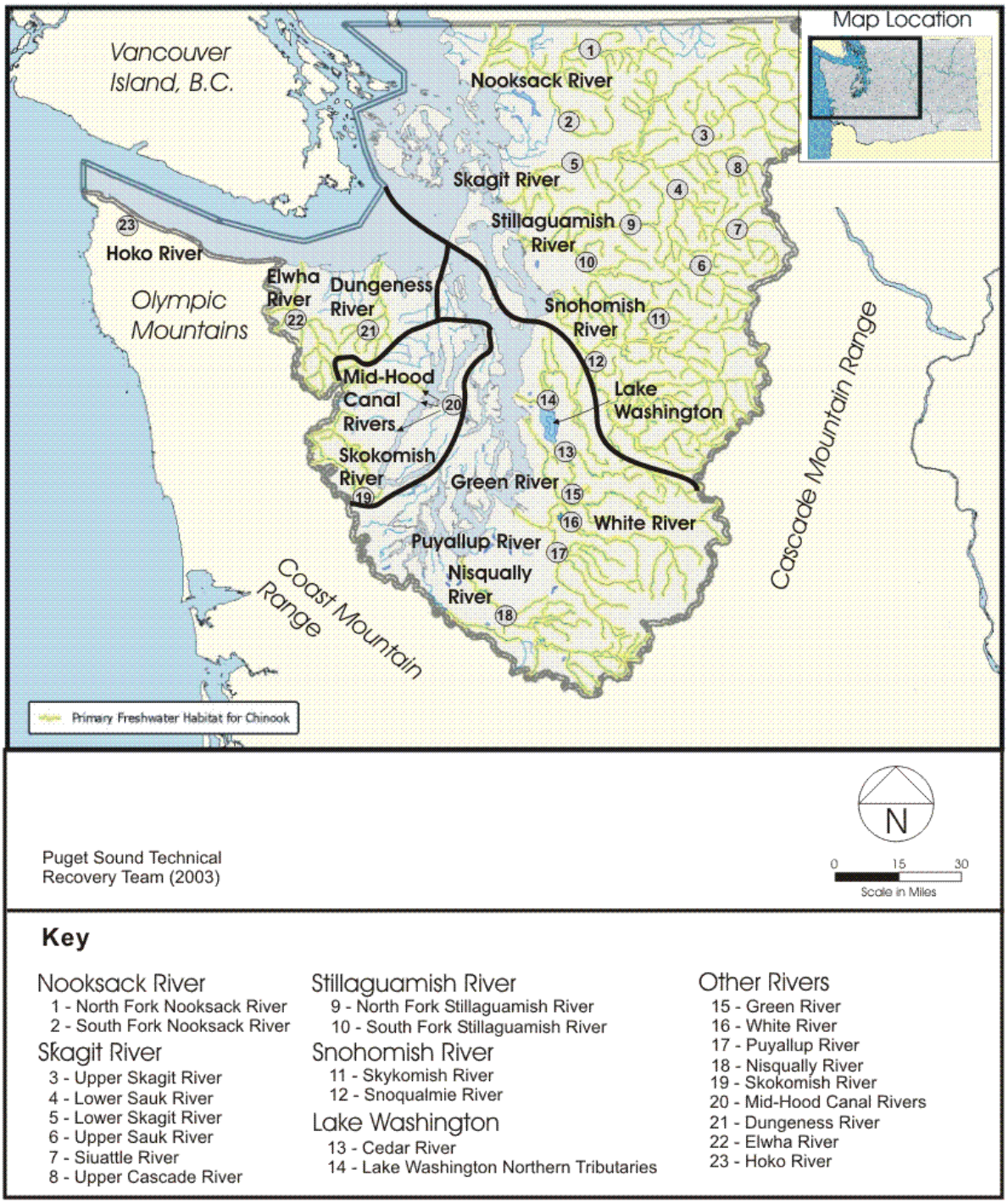


Figure 3.2-6. Hood Canal Summer-Run Chum Salmon Evolutionarily Significant Unit: Land ownership pattern.